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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: R13-3260A
Plant ID No.: 017-00157
Applicant: Antero Treatment LLC (Antero)
Facility Name: Antero Clearwater Facility
Location: Greenwood, Doddridge County
NAICS Code: 213112 (Support Activities for Oil and Gas Operations)
Application Type: Modification
Received Date: September 27, 2016
Engineer Assigned: Jerry Williams, P.E.
Fee Amount: \$2,000.00
Date Received: September 27, 2016
Complete Date: October 24, 2016
Due Date: January 22, 2017
Applicant Ad Date: September 30, 2016
Newspaper: *The Doddridge Independent*
UTM's: Easting: 509.222 km Northing: 4,346.659 km Zone: 17
Description: Water treatment facility for oil and gas operation support.

DESCRIPTION OF PROCESS

Permit R13-3260 was issued to Antero on December 7, 2015 for the operation and construction of a water treatment facility for oil and gas operation support.

This modification application consists of:

- Modification of the emergency generator model
- Modification to the operation of the boilers to take an 89% fuel limitation from maximum and change the status of the facility to a synthetic minor
- Modification to the thermal oxidizer heat rating and operation

Promoting a healthy environment.

- Modification of operations in the thermal portion of the facility resulting in emission changes to a few tanks and the salt disposal
- Addition of a fire water pump engine
- Addition of an emergency flare for the gas blanket stream
- Addition of tanks and a change to the Pre-treatment operations at the facility
- Addition and removal of some of the chemical tanks (insignificant emissions)
- Addition of a calcium carbonate stream
- Addition of an offsite fuel conditioning skid that will support the facility

The following process description was taken from Permit Application R13-3260A:

The water treatment facility was designed to treat wastewater associated with shale development to an effluent water purity suitable for surface discharge or reuse with future oil and gas operations. The treatment system includes the following processes:

- Brine pre-treatment system including truck offloading, clarification, equalization, solids contact clarifier for selective ion removal and equalization
- Thermal brine treatment system
- Post-treatment system

Upstream Equipment – Truck Off-loading Station

The influent to the water treatment facility will be delivered by trucks (PROAD). An offloading station will be provided with 16 truck bays (P-1051). The water will flow from offload bays to the clarifiers (TK-1055A and TK-1055B). All pumping units at the facility are electric-powered and have no associated emissions. Leachate from the Antero Landfill may also be pumped to the influent water stream for treatment at the Clearwater Facility.

Pre-Treatment Technology Description

Grit Clarifiers

The raw influent is transferred to two Grit Clarifiers (TK-1055A and TK-1055B) operating in parallel. Each clarifier is designed to be able to accept simultaneous flow from all of the sixteen truck offloading stations if required (i.e., if one clarifier is out of service), but normally, flow will be split equally between the two clarifiers. Each clarifier will have the capability for solids and oil removal. Solids from the Grit Clarifiers (TK-1055A and TK-1055B) will be pumped to the Sludge Holding Tank (TK-2020). Oil that is removed from the Grit Clarifiers (TK-1055A and TK-1055B) will be pumped to the Oil Collection Tank (TK-1065). Water will flow from the Grit Clarifiers (TK-1055A and TK-1055B) into the small Clarifier Pump Tanks (TK-1060A and TK-1060B) before being pumped to a larger Equalization Tank (TK-1070). The Grit Clarifiers (TK-1055A and TK-1055B) and the Clarifier Pump Tanks (TK-1060A and TK-1060B) will all be covered and vented, with all off-gas being routed to a Thermal Oxidizer (U-1080).

Equalization Tank

Water will be pumped from the Clarifier Pump Tanks (TK-1060A and TK-1060B) to an Equalization Tank (TK-1070). The Equalization Tank (TK-1070) will include an oil removal device. Oil that is removed from the tank will also be pumped to the Oil Collection Tank (TK-1065). The Clarifier Pump Tanks (TK-1060A and TK-1060B) and Equalization Tank (TK-1070) will be covered and vented, with all off-gas being routed to the Thermal Oxidizer (U-1080).

Oil Collection Tank

Oil from the Grit Clarifiers (TK-1055A and TK-1055B) and the Equalization Tank (TK-1070) is pumped to an Oil Collection Tank (TK-1065) and then trucked offsite (OILLOAD). The Oil Collection Tank (TK-1065) will be covered and vented, with all off-gas being routed to the Thermal Oxidizer (U-1080).

Solids Contact Clarifier

The water is pumped from the Equalization Tank (TK-1070) and enters the Solids Clarifier Tank (TK-2010) where select constituents are chemically removed. Select constituent removal aids in both incremental water treatment, as well as protection and optimal water chemistry for the thermal system's equipment and process. The solids generated during pretreatment are removed from the Solids Clarifier Tank (TK-2010) and pumped to the Sludge Holding Tank (TK-2020). The clarified effluent from the Solids Clarifier Tank (TK-2010) will flow into a Clarifier Effluent Tank (TK-2015). All of the tanks in this process are covered and vented with all off-gas routed for emissions control by the Thermal Oxidizer (U-1080).

Pre-Treatment Dewatering System

The volumetric feed to the Sludge Holding Tank (TK-2020) will consist of sludge from the Solids Clarifier Tank (TK-2010) and sludge from the Grit Clarifiers (TK-1055A and TK-1055B). The sludge is continuously pumped from the Sludge Holding Tank (TK-2020) to Dewatering Equipment which is housed in a building. Recovered filtrate from dewatering equipment is then sent to the Sludge Filtrate Sump (SP-2030) for temporary storage before it is recycled to the Grit Clarifiers (TK-1055A and TK-1055B) to be retreated. The dewatered cake will be transferred to appropriate disposal containers which are filled directly on truck under a covered canopy. The dewatered cake will be transported to an appropriate landfill for disposal (DISP1). The dewatering equipment will also be operated 24 hours per day, 7 days per week.

Thermal Feed Tank

Effluent from the Solids Clarifier Tank (TK-2010) will flow into a small Clarifier Effluent Tank (TK-2015) and will then be pumped to the Thermal Feed Tank (TK-2040). The Thermal Feed Tank (TK-2040) will be covered and vented, with all off-gas being routed to a Thermal Oxidizer (U-1080). An off-spec line will also be added so that the water can be recycled back to the front of the pre-treatment system in the event that it is not acceptable as feed to the thermal system.

Stage 1 Sludge Segregation System

The pre-treatment portion of the facility will initially be operated as described above. In the later stages of commissioning a Stage 1 Sludge Segregation System will be integrated and from that point forward the pre-treatment operation will occur as described below.

Grit Clarifiers

When the Stage 1 Sludge Segregation System is integrated, the raw influent will be transferred to a single Grit Clarifier (TK-1055A), while the other Grit Clarifier (TK-1055B) will be repurposed downstream. At this time, solids from the Grit Clarifier (TK-1055A) will be pumped (i.e., redirected) to a Stage 1 Sludge Holding Tank (TK-1120). The rest of the Grit Clarifier System will operate as described above under the original pre-treatment scheme.

Equalization Tank

The Equalization Tank will operate in an identical manner as described above under the original pre-treatment scheme.

Oil Collection Tank

The Oil Collection Tank will operate in an identical manner as described above under the original pre-treatment scheme.

Stage 1 Reaction Tanks and Clarifier

The water is pumped from the Equalization Tank (TK-1070) and enters the Stage 1 Reaction Tanks (TK-1105A and TK-1105B) where select constituents (including radium) are chemically precipitated and then removed in the downstream Stage 1 Clarifier (TK-1055B; repurposed Grit Clarifier). These precipitated solids are routed to Stage 1 Sludge Dewatering System which is housed in a building and transferred to appropriate disposal containers also loaded inside a building. These dewatered solids will be transferred offsite for disposal at an appropriate landfill (DISP 3).

The solids generated during this step are removed from the Stage 1 Clarifier (TK-1055B) and pumped to the Stage 1 Sludge Holding Tank (TK-1120). The clarified effluent from the Stage 1 Clarifier (TK-1055B) will flow into a Stage 1 Clarifier Pump Tank (TK-1115). All of the tanks in this process are covered and vented with all off-gas routed for emissions control by the Thermal Oxidizer (U-1080).

Stage 1 Sludge Dewatering System

The volumetric feed to the Stage 1 Sludge Holding Tank (TK-1120) will consist of sludge from the Stage 1 Clarifier (TK-1055B) and sludge from the Grit Clarifier (TK-1055A). The sludge is intermittently pumped from the Stage 1 Sludge Holding Tank (TK-1120) to the Stage 1 Dewatering Equipment. Recovered filtrate from dewatering equipment is then sent to the Stage 1 Filtrate Tank (TK-1130) for temporary storage before it is recycled to the Stage 1 Reaction Tanks (TK-1105A and TK-1105B) to be retreated. The dewatered cake will be transferred to an appropriate landfill for disposal (DISP3).

Solids Contact Clarifier

The water is pumped from the Stage 1 Clarifier Pump Tank (TK-1115) and enters the Solids Clarifier Tank (TK-2010) where select constituents are chemically removed. Select constituent removal aids in both incremental water treatment, as well as protection and optimal water chemistry for the thermal system's equipment and process.

The solids generated during pretreatment are removed from the Solids Clarifier Tank (TK-2010) and pumped to the Stage 2 Sludge Holding Tank (TK-2020). The clarified effluent from the Solids Clarifier Tank (TK-2010) will flow into a Clarifier Effluent Tank (TK-2015). All of the tanks in this process are covered and vented with all off-gas routed for emissions control by the Thermal Oxidizer (U-1080).

Solids Contact Clarifier Dewatering System

The volumetric feed to the Stage 2 Sludge Holding Tank (TK-2020) will consist of sludge from the Solids Clarifier Tank (TK-2010). The sludge is continuously pumped from the Stage 2 Sludge Holding Tank (TK-2020) to the Stage 2 Dewatering Equipment. Recovered filtrate from

dewatering equipment is then sent to the Stage 2 Sludge Filtrate Sump (SP-2030) for temporary storage before it is recycled to the Grit Clarifier (TK-1055A) to be retreated. The dewatered cake will be transferred to an appropriate landfill for disposal (DISP1).

Thermal Feed Tank

The Thermal Feed Tank (TK-2040) will operate in an identical manner as described above under the original pre-treatment scheme.

Thermal Process System

Thermal Feed brine is pumped from the Crystallizer Feed Tank (TK-2040) into the thermal system. Steam from two (2) natural gas-fired boilers (H-2185A and H-2185B) provides the energy to drive the thermal process. A small amount of steam is passed through the Deaerator (E-2076) counter-current to the feed brine. The vent from the Deaerator (E-2076) will include components such as ammonia and volatile organics which are sent to the thermal oxidizer (U-1080). Deaerator brine from the Deaerator is temporarily stored in the Process Distillate Level Tank (TK-2120). Slurry from the thermal process is pumped to the dewatering building where solids are removed for disposal (DISP2). Centrate from the dewatering process is returned to the thermal process after temporary storage in the Disposal Centrate Tanks (TK-2160 and TK-2460).

The vast majority of the water that enters the system leaves as clean, recovered distillate. Condensed vapors from the thermal system flow by gravity to a Barometric Condenser Hot Well (TK-2130) before being transferred to the Recovered Water Tank (TK-2140). Vapors from the Recovered Water Tank (TK-2140) are sent to the Thermal Oxidizer (U-1080). Most often, this distillate is planned to be reused in future oil and gas operations. If distillate production exceeds the need for recycled fracing water, the balance of the distillate stream may be discharged to a surface water source, but only if the chemical makeup of that distillate complies with strict water quality standards designated by appropriate government permits. This water treatment facility has been designed to meet those anticipated discharge water quality requirements. Condensate from the Thermal System is collected in a Steam Condensate Flash Tank (TK-2085) before being transferred to a Condensate Treatment System and then collected in a Boiler Feedwater Tank (TK-2180). The condensate leaves the Boiler Feedwater Tank (TK-2180) and is pumped to the Boiler Deaerator Tank (TK-2315) prior to feeding the Boiler System. Blowdown from the Boiler System is collected in the Boiler Blowdown Flash Tank (TK-2450) and recycled into the process. The Condensate Treatment Process includes an ion exchange system that needs to be regenerated with brine. The brine will be stored in the Brine Maker (TK-2149) until it is required for regeneration. Cooling water is required for various uses. Plant service water is used as make-up water to the cooling tower (CT-2335); this water is treated distillate, so it is of high quality. Blowdown from the tower will be released based on cooling water conductivity. A cooling tower treatment package is included to satisfy regulatory requirements associated with the operation of the tower. One or more biocides will be added to control biological activity and to control health risks. In the event that chemical cleaning is required in the Thermal System, the CIP Tank (TK-2320) will be used to store the cleaning solution that will be fed to the Thermal System.

Post-Treatment

From the Thermal System, distillate will flow to the Recovered Water Tank (TK-2140), which will be covered and vented with all off-gas being routed to the Thermal Oxidizer (U-1080). Distillate will then flow to Post Treatment Tank 1 (TK-2500) followed by Post Treatment Tanks 2 and 3 (TK-2550 and TK-2555). This is where the distillate will be post-treated for reduction of ammonia and benzene in order to achieve a water quality that is suitable for discharge to the environment. The treated water will then flow into the Post Treatment Clarifier (CF-2510) and the Post Treatment Effluent Tank (TK-2515), through one final post treatment process, and finally to the Product Water Storage Tank (TK-2545) before leaving site as qualifying effluent. Any sludge generated in the post treatment process will be sent to the Post Treatment Sludge Tank (TK-2520) and ultimately the same dewatering system as the pretreatment sludge by being returned to the Grit Clarifier in the pretreatment process.

During initial commissioning, a Breakpoint Chlorination Frac Tank (TK-2800) will be utilized to temporarily treat the distillate water for ammonia reduction.

Chemical Storage

Throughout the process flow, a number of chemicals will be stored and pumped throughout the site to assist in water treatment. These chemical material safety data sheets have been included in Attachment H of this application. Below is a tabled reference to all of the small storage bins and tanks that hold these chemicals. Some of these storage vessels hold inorganic materials or solids therefore have no resulting emissions. Please see the Emissions Summary in Attachment N of the permit application for a full explanation for each vessel.

Ferric Chloride Storage Tank (TK-4000)	Sodium Bicarbonate Silo (TK-4012)	Caustic Bulk Storage Tank (TK-4020)
Hydrogen Peroxide Bulk Tank (TK-4025)	Sodium Sulfate Silo (TK-4036)	Sodium Sulfate Day Tank (TK-4039)
Lime Silos A/B (TK-4046A/B)	Lime Slurry Tanks A&B (TK-4049A/B)	Polymer Totes (TK-4054, TK-4057, TK-4120, TK-4155, and TK-4310)
Urea Tote (TK-4065)	Sodium Bisulfite Bulk Tank (TK-4080)	Methanol Bulk Storage Tank (TK-4115)
Phosphoric Acid Tote (TK-4125)	Micronutrient Tote (TK-4150)	Sodium Hypochlorite Tote (TK-4185)
Hydrex 2252 Tote (TK-4190)	Calcium Chloride Bulk Tank (TK-4200)	Hydrex 2233 Tote (TK-4210)
Hydrex 1425 Tote (TK-4220)	Hydrex 1317 Tote (TK-4230)	Hydrex 1565 Tote (TK-4240)
Hydrex 1605 Tote (TK-4250)	Demulsifier Tote (TK-4260)	Calcium Carbonate Silo (TK-4301)
Actiflo Polymer System Aging Tank (TK-4170)	Antiscalant Tote (TK-4255)	Liquid Carbon Dioxide Tank (TK-4075)
Breakpoint Chlorination System Sodium Hypochlorite Bulk Tank (TK-4500)	Antifoam Tote (TK-4015)	Crystallizer Antifoam Tote (TK-4270)
Sodium Bicarbonate Day Tank (TK-4017)		

Fuel Conditioning Skid

An offsite fuel conditioning skid will be used to condition the fuel gas that will be used at the Clearwater Facility. This skid will contain two (2) - 2.4 MMBtu/hr heaters (HTFUEL1 and HTFUEL2), and a pig receiver (VENT1). Other equipment located at the skid, such as a 500 gallon dry gas tank (TK-SLOP), an inlet separator, scrubber, and pressure vessel, will be in a closed loop and will not produce any emissions.

Other Support Equipment

An emergency generator (GEN-1) is located at the facility and will be used to shut down the facility in case of emergency. This generator will not supply long term backup power. An emergency flare (U-1090) located at the facility will be used to treat the gas blanket (waste gas header) bleed stream when the thermal oxidizer is down for maintenance. Lastly, a fire water pump engine (ENG-2) will provide fire water to the cooling tower only in case of emergency.

SITE INSPECTION

A site inspection was conducted on August 12, 2016 by the writer. I met with Conrad Baston and Bryan Radabaugh of Antero. The facility was under construction and was not operating at that time.

Latitude: 39.26922
Longitude: -80.89310

Directions to the facility are as follows:

From Greenwood: Facility located off of US-50 on access road off of Gum Run Road (50/36)



ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Emissions associated with this facility consist of one (1) diesel-fired emergency generator (1E), two (2) natural gas-fired boilers (2E, 3E), one (1) thermal oxidizer (4E) controlling multiple process tanks, multiple storage tanks and fugitive emissions. Fugitive emissions from the facility are negligible due to the fact that most processes are in the liquid phase or are less than 1% VOC. Once the process moves to the vapor phase, the volatiles and oils have been removed, are adsorbed by the solids or otherwise consumed in the process. The following table indicates which methodology was used in the emissions determination:

Emission Point ID#	Process Equipment	Calculation Methodology
1E	2,923 HP Diesel-Fired Emergency Generator	Manufacturer's Data, EPA AP-42 Emission Factors
2E, 3E	Two (2) 275.3 MMBTU/hr NG-Fired Boilers	Manufacturer's Data, EPA AP-42 Emission Factors
4E	Thermal Oxidizer	EPA AP-42 Emission Factors, Engineering Estimate
TL	Truck Unloading Influent Water	EPA AP-42 Emission Factors
28E	Cooling Tower	EPA AP-42 Emission Factors
29E	2.2 MMBTU/hr Emergency Flare	EPA AP-42 Emission Factors, Engineering Estimate
30E	136 HP Fire Water Pump Engine	Manufacturer's Data, EPA AP-42 Emission Factors
31E, 32E	Two (2) 2.4 MMBTU/hr Fuel Skid Heaters	EPA AP-42 Emission Factors
Waste Gas Header (4E)	TK-1055A/B, TK-1060A/B, TK-1065, TK-1070, TK-1105A/B, TK-1115, TK-1120, TK-1130, TK-2010, TK-2015, TK-2020, TK-2040, TK-2130, TK-2140, TK-2160, E-2076	WATER9, TANKS 4.09d, Material Balance
Post Treatment System	TK-2500, TK-2550, TK-2555, CF-2510, TK-2520, TK-2515	Material Balance, WATER9
Sludge and Wetcake Disposal	DISP1, DISP2, DISP3	Material Balance, EPA Emission Factors
Storage Tank W&B Losses	TK-2120, TK-4115	EPA Tanks 4.09d
Sodium Sulfate Feeder	TK-4036, U-4037, U-4038	EPA AP-42 Emission Factors
Bulk Lime Feeder A	TK-4046A, U-4047A, U-4048A	EPA AP-42 Emission Factors
Bulk Lime Feeder B	TK-4046B, U-4047B, U-4048B	EPA AP-42 Emission Factors
Sodium Bicarbonate Feeder	TK-4011, U-4012, U-4013	EPA AP-42 Emission Factors
Calcium Bicarbonate Feeder	TK-4301, U-4302, U-4303	EPA AP-42 Emission Factors
Fugitive Dust	Vehicle Travel on Facility Roads	EPA AP-42 Emission Factors

The total facility PTE (including fugitives) for the Antero Clearwater Facility is shown in the following table:

Pollutant	R13-3260 PTE (tons/year)	R13-3260A PTE (tons/year)	PTE Change (tons/year)
Nitrogen Oxides	94.86	91.94	-2.92
Carbon Monoxide	95.41	90.01	-5.40
Volatile Organic Compounds	44.94	79.52	34.58
Particulate Matter-10	26.94	37.27	10.33
Particulate Matter-2.5	22.27	29.03	6.76
Sulfur Dioxide	1.82	1.36	-0.46
Total HAPs	3.90	4.61	0.71
Carbon Dioxide Equivalent	301,969	276,498	-25,471

The total non-fugitive facility PTE for the Clearwater Facility (water treatment facility and landfill) is shown in the following table:

Pollutant	R13-3260A PTE Water Treatment Facility (tons/year)	R13-3331 PTE Landfill Facility (tons/year)	Facility ID 017-00157 Total (tons/year)
Nitrogen Oxides	91.94	0.27	92.21
Carbon Monoxide	90.01	0.27	90.28
Volatile Organic Compounds	59.14	0.01	59.15
Particulate Matter-10	26.08	17.55	43.63
Particulate Matter-2.5	26.08	2.13	28.21
Sulfur Dioxide	1.36	0.07	1.43
Total HAPs	4.61	<0.01	4.61
Carbon Dioxide Equivalent	276,498	30	276,528

Fugitive particulate matter emissions associated with the Clearwater Facility consist of 6.30 tons/year of PM₁₀ and 2.95 tons/year of PM_{2.5}. Fugitive VOC emissions associated with the Clearwater Facility are 20.39 tons/year.

Maximum detailed controlled point source emissions were calculated by Antero and checked for accuracy by the writer and are summarized in the table on the next page.

Antero Treatment LLC – Antero Clearwater Facility (R13-3260A)

Emission Point ID#	Source	NO _x		CO		VOC		PM-10		PM-2.5		SO ₂		Total HAPs		CO ₂ e
		lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	
1E	Emergency Generator	25.78	6.45	16.83	4.21	2.69	0.67	0.96	0.24	0.96	0.24	0.03	0.01	0.03	0.01	900
2E	Boiler	10.03	39.21	10.17	39.79	1.10	4.31	2.75	10.77	2.75	10.77	0.16	0.63	0.51	1.99	126393
3E	Boiler	10.03	39.21	10.17	39.79	1.10	4.31	2.75	10.77	2.75	10.77	0.16	0.63	0.51	1.99	126393
4E	Thermal Oxidizer (Controlled Tanks)	1.08	4.74	0.93	4.08	4.41	15.58	0.0001	0.0006	0.0001	0.0006	0.00001	0.00005	0.01	0.03	5939
TUL	Truck Unloading Influent Water	0	0	0	0	18.59	16.86	0	0	0	0	0	0	0.12	0.11	15015
TL	Truck Loading of Oil	0	0	0	0	16.70	8.72	0	0	0	0	0	0	0.28	0.15	2
28E	Cooling Tower	0	0	0	0	0	0	0.94	4.12	0.94	4.12	0	0	0	0	0
TKS	Process Tanks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TKS	Storage Tanks	0	0	0	0	1.97	7.90	0	0	0	0	0	0	0.01	0.05	483
29E	Emergency Flare	0.16	0.06	0.69	0.14	1.25	0.21	0.0006	0.0024	0.0006	0.0024	0.0000	0.0002	0.0001	0.001	82
30E	Fire Water Pump Engine	0.85	0.21	1.11	0.28	0.04	0.01	0.07	0.02	0.07	0.02	0.27	0.07	0.0035	0.0009	39
31E	Fuel Skid Heater	0.24	1.03	0.20	0.87	0.01	0.06	0.02	0.08	0.02	0.08	0.00	0.01	0.0045	0.02	617
32E	Fuel Skid Heater	0.24	1.03	0.20	0.87	0.01	0.06	0.02	0.08	0.02	0.08	0.00	0.01	0.0045	0.02	617
VENT1	Fuel Skid Pig Venting	0	0	0	0	7.53	0.20	0	0	0	0	0	0	0.18	0.0047	18
Total Clearwater Point Source		48.39	91.94	40.30	90.01	55.48	59.14	7.51	26.08	7.51	26.08	0.63	1.36	1.73	4.61	276498
FUG	Sludge and Salt Disposal	0	0	0	0	4.66	20.39	0	0	0	0	0	0	0.0008	0.0034	0
FUG	Bulk Transfer Points	0	0	0	0	0	0	2.65	5.64	0.75	1.59	0	0	0	0	0
FUG	Fugitive Dust Emissions	0	0	0	0	0	0	1.41	5.55	0.35	1.36	0	0	0	0	0
Total Clearwater Fugitive		0	0	0	0	4.66	20.39	4.06	11.19	1.10	2.95	0	0	0.0008	0.0034	0
Total Clearwater Sitewide		48.39	91.94	40.30	90.01	60.15	79.52	11.57	37.27	8.61	29.03	0.63	1.36	1.73	4.61	276498
Landfill Facility Point Source		0.90	0.27	0.96	0.27	0.05	0.01	7.09	17.55	0.89	2.13	0.21	0.07	0.0026	0.0007	30
Clearwater + Landfill Point Source		49.29	92.21	41.26	90.28	55.53	59.15	14.60	43.63	8.40	28.21	0.84	1.43	1.73	4.61	276528

REGULATORY APPLICABILITY

The following rules apply to the facility:

45CSR2 (Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers)

The purpose of 45CSR2 is to establish emission limitations for smoke and particulate matter which are discharged from fuel burning units. 45CSR2 states that any fuel burning unit that has a heat input under ten (10) million B.T.U.'s per hour is exempt from sections 4 (weight emission standard), 5 (control of fugitive particulate matter), 6 (registration), 8 (testing, monitoring, recordkeeping, reporting) and 9 (startups, shutdowns, malfunctions). However, failure to attain acceptable air quality in parts of some urban areas may require the mandatory control of these sources at a later date.

Antero is subject to the opacity requirements in 45CSR2, which is 10% opacity based on a six minute block average. Antero is also subject to the weight emission standard for particulate matter under 45CSR2. According to 45CSR2 Section 4.1.b, for Type 'b' fuel burning units, the product of 0.09 and the total design heat inputs for such units in million B.T.U.'s per hour. Therefore, each 275.3 MMBTU/hr natural gas fired boiler (2E, 3E), could not exceed 24.77 lb/hr of particulate matter. Each boiler (2E, 3E) has particulate matter emissions of 2.75 lb/hr. Therefore, Antero will meet this rule.

The individual heat input of the fuel conditioning skids (HTFUEL1, HTFUEL2) are below 10 MMBTU/hr. Therefore, these units are exempt from the aforementioned sections of 45CSR2.

Antero would also be subject to the opacity requirements in 45CSR2, which is 10% opacity based on a six minute block average.

45CSR6 (To Prevent and Control Air Pollution from the Combustion of Refuse)

The purpose of this rule is to prevent and control air pollution from combustion of refuse.

Antero has one (1) thermal oxidizer and one (1) emergency flare at the facility. These units are subject to section 4, emission standards for incinerators. These units have negligible hourly particulate matter emissions. Therefore, the facility's thermal oxidizer and emergency flare should demonstrate compliance with this section. The facility will demonstrate compliance by maintaining records of the amount of natural gas consumed by these units and the hours of operation. The facility will also monitor the flame of these units and record any malfunctions that may cause no flame to be present during operation.

45CSR10 (To Prevent and Control Air Pollution from the Emission of Sulfur Oxides)

The purpose of 45CSR10 is to establish emission limitations for sulfur dioxide which are discharged from fuel burning units. 45CSR10 states that any fuel burning unit that has a heat input under ten (10) million B.T.U.'s per hour is exempt from sections 3 (weight emission standard), 6 (registration), 7 (permits), and 8 (testing, monitoring,

recordkeeping, reporting). However, failure to attain acceptable air quality in parts of some urban areas may require the mandatory control of these sources at a later date.

Antero will meet the weight emission standard for sulfur dioxide set forth in 45CSR10 which is 3.1 lb/MMBtu. For each 275.3 MMBTU/hr natural gas fired boiler (2E, 3E), the weight emission standard for a Type 'b' fuel burning unit would be 853.43 lb/hr for the natural gas fired boilers. The hourly sulfur dioxide rate set forth in Permit Application R13-3260A is 0.16 lb/hr for each natural gas fired boiler. Therefore, Antero will meet this rule. Antero will demonstrate compliance with this requirement by monitoring the amount of natural gas consumed by the boilers.

The individual heat input of the fuel conditioning skids (HTFUEL1, HTFUEL2) are below 10 MMBTU/hr. Therefore, these units are exempt from the aforementioned sections of 45CSR10.

45CSR13 (Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation)

A 45CSR13 modification permit applies to this source due to the fact that Antero is subject to a substantive requirement of an emission control rule (40CFR60 Subparts Db and IIII). In addition, because a limitation was placed on the maximum annual fuel consumption of the boilers to remain below major source thresholds for NO_x and CO, Antero is subject to Notice Level C (45CSR13 Section 8.5) and will be required to publish a commercial display ad (45CSR13 Section 8.4.a) and post a visible sign at their facility (45CSR13 Section 8.5.a).

Antero paid the appropriate application fee and published the required legal advertisement for a modification permit application.

45CSR16 (Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60)

45CSR16 applies to this source by reference of 40CFR60, Subparts Db and IIII. These requirements are discussed under those rules below.

45CSR30 (Requirements for Operating Permits)

The source is a nonmajor source subject to 45CSR30, because the facility is subject to 40CFR60 Subpart Db. This facility is a deferred Title V source.

45CSR40 (Control of Ozone Season Nitrogen Oxide Emissions)

This rule establishes general provisions for nitrogen oxide emissions from various emission units. The two (2) 275.3 MMBTU/hr boilers (2E, 3E) are subject to continuous emission monitoring (CEM) requirements as part of this rule.

40CFR60 Subpart Db (Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units)

This rule applies to steam generating units with a heat input capacity greater than 100 MMBTU/hr for which construction commenced after June 19, 1984. The 275.3 MMBTU/hr boilers (2E, 3E) that Antero proposes to install will be subject to this rule. These units are subject to the New Source Performance Standards of Subpart Db since each unit will have a design heat input rating of greater than 100 MMBtu/hr. 40CFR60 Subpart Db establishes performance standards by pollutant by fuel type (i.e. coal, oil, and natural gas). For natural gas fired units, the subpart only establishes a performance standard for NO_x emissions. These units will be constructed after July 9, 1997 which makes the unit applicable to the limit in 40 CFR §60.44b(l) of 0.20 lb of NO_x (expressed as NO₂) per MMBtu. These units will be equipped with a low-NO_x burner with a maximum NO_x rate of 0.036 lb/MMBtu. At this NO_x rating, these units would have a margin of compliance of 18% of the applicable NO_x limit.

Subpart Db requires affected sources to demonstrate compliance with the NO_x limit on a 30 day rolling average. This subpart will require the use of a NO_x continuous emission monitoring system (NO_x CEMS) with a means to measure either O₂ or CO₂ in the exhaust for demonstrating compliance with the NO_x emission standard.

40CFR60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (CI ICE))

Subpart IIII sets forth non-methane hydrocarbon (NMHC), hydrocarbon (HC), nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM) emission limits, fuel requirements, installation requirements, and monitoring requirements based on the year of installation of the subject internal combustion engine.

The 2,923 HP (2,180 kW) diesel fired generator (1E) is subject to this subpart. This unit is required to meet the emission standards for emergency engines in §60.4205. These standards are 5.89 lb/hr for NO_x and 1.93 lb/hr for PM. Antero provided an EPA Certificate of Conformity which states that this engine will meet these standards.

The 136 HP (101 kW) fire water pump engine (30E) is subject to this subpart. This unit is required to meet Table 4 of 40CFR60 Subpart IIII for stationary fire pump engines. These standards are 4.0 g/kw-hr for NMHC+NO_x, 3.5 g/kw-hr for CO and 0.20 g/kw-hr for PM. Antero provided an EPA Certificate of Conformity which states that this engine will meet these standards.

40CFR63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines)

Subpart ZZZZ establishes national emission limitations and operating limitations for HAPs emitted from stationary RICE located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations. The generator

(1E) at the Antero Clearwater Facility is subject to the area source requirements for non-emergency compression ignition engines.

The applicability requirements for new stationary RICEs located at an area source of HAPs, is the requirement to meet the standards of 40CFR60 Subpart IIII. These requirements were outlined above. The proposed engines meet these standards.

The following rules do not apply to the facility:

45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants)

45CSR19 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment)

The Antero Clearwater Facility is located in Doddridge County, which is an unclassified county for all criteria pollutants, therefore it is not applicable to 45CSR19.

Antero is not a major source subject to 45CSR14 or 45CSR19 review. According to 45CSR14 Section 2.43.e, fugitive emissions are included in the major source determination because it is listed as one of the source categories in Table 1 (fossil fuel boilers (or combination thereof) totaling more than 250 MMBTU/hr heat input). The NO_x emissions from the boilers are 78.42 tons per year and the CO emissions are 79.58 tons per year.

The facility wide emissions from the Clearwater Facility and Landfill are less than 45CSR14 and 45CSR19 thresholds.

40CFR60 Subpart Kb (Standards of Performance for Volatile Organic Liquid Storage Vessels)

The affected facility to which this subpart applies is each storage vessel with a capacity greater than or equal to 75 cubic meters (m³) (19,813 gallons) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984. This subpart does not apply to storage vessels with a capacity greater than or equal to 151 m³ storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals (kPa) or with a capacity greater than or equal to 75 m³ but less than 151 m³ storing a liquid with a maximum true vapor pressure less than 15.0 kPa. This subpart also does not apply to pressure vessels designed to operate in excess of 204.9 kPa and without emissions to the atmosphere.

The storage vessels in the following table have a maximum capacity less than 75 m³ and/or do not contain a volatile liquid and are therefore exempt from this Subpart.

Oil collection tank (TK-1065)	Clarifier effluent tank (TK-2015)	Stage 1 clarifier pump tank (TK-1115)
Stage 1 filtrate tank (TK-1130)	Boiler blowdown flash tank (TK-2450)	4B disposal centrate tank (TK-2460)
CIP tank (TK-2320)	Process distillate level tank (TK-2120)	Steam condensate level tank (TK-2085)
4A disposal centrate tank (TK-2160)	Boiler deaerator tank (TK-2315)	Brine maker tank (TK-2149)
Post treatment effluent tank (TK-2515)	Post treatment sludge tank (TK-2520)	Breakpoint chlorination frac tank (TK-2800)
Sodium sulfate day tank (TK-4039)	Sodium bicarbonate day tank (TK-4017)	Lime slurry tank A and B (TK-4049A and TK-4049B)
Ferric chloride storage tank (TK-4000)	Caustic bulk storage tank (TK-4020)	Post Treatment polymer system aging tank (TK-4170)
Calcium chloride bulk tank (TK-4200)	Breakpoint chlorination sodium hypochlorite tank (TK-4500)	Methanol bulk storage tank (TK-4115)
Barometric condenser hot well (TK-2130)	Hydrogen peroxide tank (TK-4025)	Sodium bisulfite tank (TK-4080)
All totes (TK-4054, 4057, 4120, 4155, 4015, 4125, 4150, 4065, 4185, 4190, 4210, 4220, 4230, 4240, 4250, 4260, 4310, 4255, 4270)		

The Clarifier Pump Tanks A & B (TK-1060A and TK-1060B) each have a capacity between 75 m³ and 151 m³ with a vapor pressure less than 15 kPa (2.18 psia) and are therefore exempt from this Subpart.

The following tanks have a maximum storage capacity greater than 151 m³ and are exempt from this Subpart since their vapor pressure will be less than 3.5 kPa.

Grit clarifier tank (TK-1055A)	Equalization tank (TK-1070)	Thermal feed tank (TK-2040)
Sludge Holding Tank (TK-2020)	Boiler Feedwater Tank (TK-2180)	Recovered Water Tank (TK-2140)
Post Treatment Tank 1 (TK-2500)	Post Treatment Tank 2 (TK-2550)	Post Treatment Tank 3 (TK-2555)
Product Water Storage Tank	Stage 1 Clarifier	Solids Clarifier Tank

(TK-2545)	(TK-1055B)	(TK-2010)
Post Treatment System Tanks (CF-2510)	Stage 1 sludge holding tank (TK-1120)	Stage 1 reaction tanks A & B (TK-1105A & TK-1105B)

As shown in the regulatory analysis above, 40 CFR60 Subpart Kb is not applicable to the storage vessels at Antero Clearwater Facility.

40CFR60 Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution)

EPA published in the Federal Register new source performance standards (NSPS) and air toxics rules for the oil and gas sector on August 16, 2012. 40CFR60 Subpart OOOO establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO₂) emissions from affected facilities that commence construction, modification or reconstruction after August 23, 2011.

There are no affected sources located within the Antero Clearwater Facility.

40CFR60 Subpart QQQ (Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems)

This rule applies to facilities constructed, modified or reconstructed after May 4, 1987 that operate an oil-water separator at a petroleum refinery.

There are no affected sources located within the Antero Clearwater Facility.

40CFR63 Subpart DD (National Emission Standards for Hazardous Air Pollutants from Off-Site Waste and Recovery Operations)

This rule applies to certain provisions of wastewater treatment facilities that are a major source of HAPs. The Antero Clearwater Facility is not a major source of HAPs, therefore, this rule would not apply.

40CFR63 Subpart DDDDD (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters)

This rule applies to boilers that are a major source of HAPs. The Antero Clearwater Facility is not a major source of HAPs, therefore, this rule would not apply.

40CFR63 Subpart JJJJJJ (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources)

This rule applies to boilers at major and area sources of HAP emissions. The boilers (2E, 3E) are located at an area source of HAPs. These boilers will be firing natural gas only. Therefore, they meet the exemption criteria in §63.11193, therefore, this rule would not apply.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The majority of non-criteria regulated pollutants fall under the definition of HAPs which, with some revision since, were 188 compounds identified under Section 112(b) of the Clean Air Act (CAA) as pollutants or groups of pollutants that EPA knows or suspects may cause cancer or other serious human health effects. The following HAPs are common to this industry. The following table lists each HAP's carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

HAPs	Type	Known/Suspected Carcinogen	Classification
Formaldehyde	VOC	Yes	Category B1 - Probable Human Carcinogen
Benzene	VOC	Yes	Category A - Known Human Carcinogen
Ethylbenzene	VOC	No	Inadequate Data
Toluene	VOC	No	Inadequate Data
Xylenes	VOC	No	Inadequate Data
n-Hexane	VOC	No	Inadequate Data
Methanol	VOC	No	Inadequate Data

All HAPs have other non-carcinogenic chronic and acute effects. These adverse health effects may be associated with a wide range of ambient concentrations and exposure times and are influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of pre-existing disease) and lifestyle. As stated previously, *there are no federal or state ambient air quality standards for these specific chemicals*. For a complete discussion of the known health effects of each compound refer to the IRIS database located at www.epa.gov/iris.

AIR QUALITY IMPACT ANALYSIS

Modeling was not required of this source due to the fact that the facility is not subject to 45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants) or 45CSR19 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment) as shown in the table listed in the Regulatory Discussion section under 45CSR14/45CSR19.

SOURCE AGGREGATION

Classifying multiple facilities as one “stationary source” under 45CSR13, 45CSR14, and 45CSR19 is based on the definition of "Building, structure, facility, or installation" as given in §45-14-2.13 and §45-19-2.12. The definition states:

“Building, Structure, Facility, or Installation” means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control). Pollutant-emitting activities are a part of the same industrial grouping if they belong to the same “Major Group” (i.e., which have the same two (2)-digit code) as described in the Standard Industrial Classification Manual, 1987 (United States Government Printing Office stock number GPO 1987 0-185-718:QL 3).

The Antero Landfill and Antero Clearwater Facility are under common control and share the same SIC code. Therefore, the potential classification of these facilities as one stationary source with any other facility depends on the determination if these stations are considered “contiguous or adjacent properties.”

“Contiguous or Adjacent” determinations are made on a case by case basis. These determinations are proximity based, and it is important to focus on this. The terms “contiguous” or “adjacent” are not defined by USEPA. Contiguous has a dictionary definition of being in actual contact; touching along a boundary or at a point. Adjacent has a dictionary definition of not distant; nearby; or having a common endpoint or border. The Antero Landfill and Antero Clearwater Facility are located on contiguous or adjacent properties.

Because the facilities are considered to be on contiguous or adjacent properties, the emissions from these facilities should be aggregated in determining major source or PSD status.

MONITORING OF OPERATIONS

Antero will be required to perform the following monitoring and recordkeeping:

- Monitor and record the hours of operation of the generator
- Opacity observations of the thermal oxidizer and emergency flare
- Quarterly AVO (audio, visual, olfactory) inspections
- Thermal oxidizer and emergency flare flame must be continuously monitored
- Liquids unloaded throughput
- Oil loading throughput
- Sludge disposal
- Wetcake disposal
- Maintain records of the hours of operation for all engines
- Boiler fuel combustion
- Maintain records of testing conducted in accordance with the permit. Said records shall be maintained on-site or in a readily accessible off-site location
- Maintain the corresponding records specified by the on-going monitoring requirements of and testing requirements of the permit

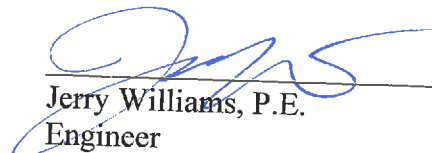
- Maintain a record of all potential to emit (PTE) HAP calculations for the entire facility.
- Maintain records of all applicable requirements of 40CFR60 Subparts Db and III
- The records shall be maintained on site or in a readily available off-site location maintained by Antero for a period of five (5) years

CHANGES TO PERMIT R13-3260

- Section 1.0 Modified the size of the emergency generator from 1,194 hp to 2,923 hp.
Modified the size of the thermal oxidizer from 3 MMBTU/hr to 11 MMBTU/hr.
Modified the name of tanks TK-1055A, TK-1055B, TK-2020, TK-2160.
Modified the size of tanks TK-2130, TK-2160, E-2076.
Removed tanks TK-2030, TK-4180.
Added tanks TK-1105A, TK-1105B, TK-1115, TK-1130.
Added emergency flare, fire water pump engine, two (2) fuel skid heaters.
- Section 1.1 Added E-2076, TK-1120, TK-1105A, TK-1105B, TK-1115, TK-1130 to units being controlled by the thermal oxidizer, and removed TK-2030 from that list.
- Section 5.0 Modified this section to account for the change in emergency generator.
- Section 6.0 Modified this section to account for the slight change in size of the two (2) boilers.
- Section 7.0 Modified this section to reflect the change in size of the thermal oxidizer.
- Section 8.0 Modified this section to include oil loading from TK-1065.
- Section 10.0 Modified this section to include E-2076, TK-1120, TK-1105A, TK-1105B, TK-1115, TK-1130 and change throughput sizes of other tanks.
- Section 11.0 Added this section to include requirements for the fire water pump engine.
- Section 12.0 Added this section to include requirements for the fuel skid heaters.
- Section 13.0 Added this section to include requirements for the emergency flare control device.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that Antero meets all the requirements of applicable regulations. Therefore, impact on the surrounding area should be minimized and it is recommended that the Antero Clearwater Facility should be granted a 45CSR13 modification permit for their facility.


Jerry Williams, P.E.
Engineer

DEC 1, 2016
Date